CHAPTER 4

PROJECT DRAWINGS

As you learned in chapter 10 of the EA3 TRAMAN, a construction drawing maybe one of several different types depending upon its intended use; and, in practice, more than one type may be used during the design and construction of a new facility or structure. For instance, a **presentation drawing** (often based on a NAVFAC **definitive design)** maybe prepared to "sell" an idea or concept for anew facility. Them, after the design phase is completed, the facility is constructed using one or more sets of **shop drawings** and, of course, a set of **project** (or **working) drawings.** Shop drawings, as you recall, are those drawings, diagrams, or other-related data that are used to illustrate a material, product, or system; for example, a shop drawing might be an assembly drawing, prepared by a manufacturer, to describe the proper steps in assembling a set of commercially purchased cabinets. Project drawings are those drawings that describe to construction crews the construction of a complete facility or structure. These drawings are most often supplemented with shop drawings and project specifications (discussed in chapter 5 of this TRAMAN).

Our discussions in this chapter center on project drawings as they pertain mostly to building construction. In the EA3 TRAMAN, you learned that NAVFAC project drawings are divided into the following categories or divisions: civil, architectural, structural, mechanical, electrical, and fire protection. Our discussions will include a brief review of the information you learned in the EA3 TRAMAN concerning these divisions. We also will expand on the EA3 TRAMAN information by including a discussion of heating, ventilating, and air-conditioning systems and drawings; riser diagrams for plumbing; and electrical wiring diagrams and schedules. In addition, you will be provided with information and tips that you can use when checking and editing project drawings.

For NAVFAC policy regarding project drawing sizes, formats, and conventions, you should refer to *Policy and Procedures for Project Drawing and Specification Preparation,* MIL-HDBK-1006/1 and to the various Department of Defense (DOD) standards, military standards, and American National Standards Institute (ANSI) standards referred to in MIL-HDBK-1006/1.

PROJECT DRAWING DIVISIONS

The following paragraphs briefly describe the contents of the drawing categories or divisions mentioned above.

CIVIL DIVISION

The drawings contained in the civil division are those that describe the existing conditions and planned development of a project site. As applicable to any particular project, the division typically includes drawings that describe, at a minimum, the following information:

1. Project location (shown on regional and vicinity maps)

2. Soil boring logs and profiles.

3. Existing site conditions to include terrain contours, buildings or structures, utilities, drainage, and other physical features on or near the project site. For small projects, this information can be shown in the site (plot) plan; however, for large or complex construction projects, it is often shown in a separate existing conditions plan.

4. Planned demolition of existing buildings, structures, utilities, or other physical features that must be demolished as a part of the project. Dependent upon the complexity of the project, you may show this in the site plan or in a separate demolition plan.

5. Planned grading for surface drainage (shown by contours or a combination of contours and spot elevations) and the planned grading and paving of driveways, access roads, and parking areas. For grading and paving, you should show plans, profiles, cross sections, and paving details as necessary to describe the new construction fully. Also show details for any curbs, gutters, sidewalks, and so forth. Again, dependent upon the complexity of the project, you may show all of this in the site plan or in a separate grading and paving plan.

6. Proposed site plan showing property boundaries, construction limits, and exactly defined locations and finished floor elevations of new buildings or structures. Each building or structure should be located using a minimum of two location dimensions.

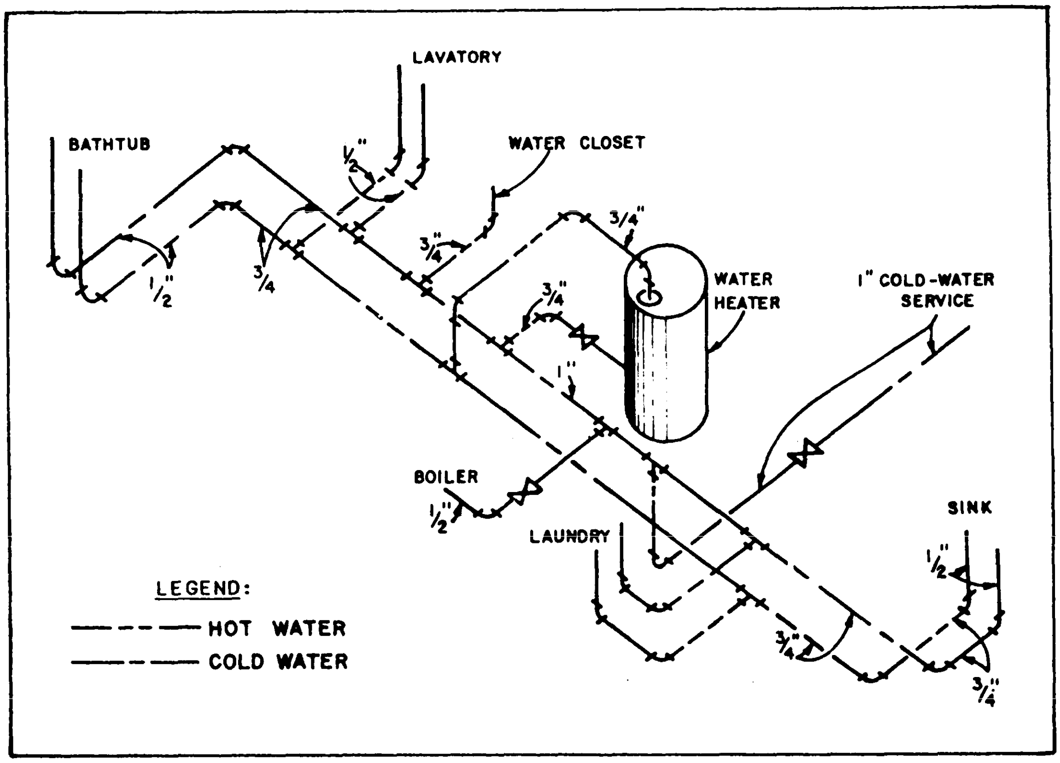

Figure 4-1.—Hot- and cold-water riser diagram.

Show the location and direction of all new utilities, unless separate utility site plans are included in other divisions, such as the mechanical, plumbing, or electrical divisions. That is sometimes done for large, complex projects.

ARCHITECTURAL DIVIS1ON

The architectural division includes drawings, such as floor and roof plans, interior and exterior elevations, millwork, door and window schedules, finish schedules, special architectural treatments, and nonstructural sections and details. For a discussion of these drawings, you should review chapter 10 of the EA3 TRAMAN.

STRUCTURAL DIVISION

The structural division is comprised of all of the drawings that fully describe the structural composition and integrity of a building or structure. Included in the division are the foundation plan and details; floor, wall, and roof framing plans and details; reinforcing plans and details; beam and column details; and other such structural plans and details. In a set of drawings, the first sheet in the structural division also should include, when applicable, roof, floor, wind, seismic, and other loads, allowable soil bearing capacity, and allowable stresses of all materials, such as concrete and reinforcing steel. Again, you should review chapter 10 of the EA3 TRAMAN.

MECHANICAL DIVISION

The mechanical division includes the plans, details, and schedules that describe the heating, ventilating, and air-conditioning (HVAC) systems equipment and installation requirements. We'll discuss more about these systems later in this chapter.

The mechanical division also includes plumbing drawings that show the fixtures, water supply and waste disposal piping, and related equipment that are to be installed in a building. The drawings include plumbing plans, riser diagrams, details, and fixture schedules. Remember, that in the order of drawings, plumbing drawings always follow the HVAC drawings.

As you recall from your study of chapters 8 and 10 of the EA3 TRAMAN, a plumbing plan (or layout) is a plan view of the fixtures, lines, and fittings to be installed in a building. For an uncomplicated building containing, let's say, one water closet and one lavatory, you can easily prepare a plumbing plan that can be clearly interpreted by the planners and estimators, inspectors, or other users of the drawing. For such a building, the plumbing plan might well be all that is

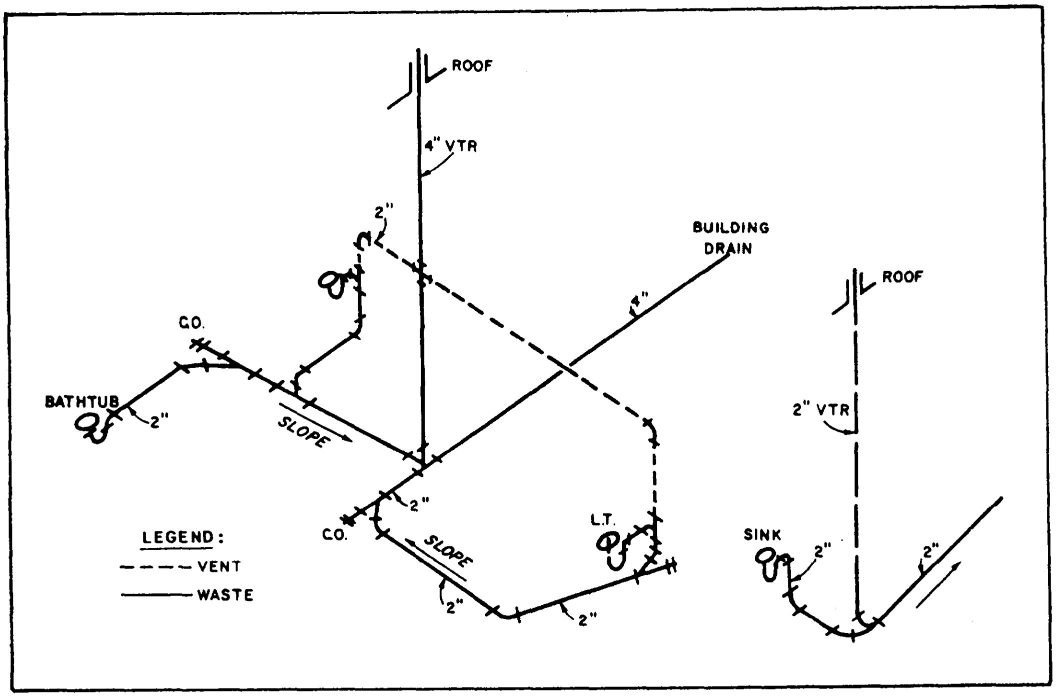

Figure 4-2.—Riser diagram for waste and soil piping.

needed to install the plumbing system. As the complexity of the building plumbing increases, however, your ability to describe the plumbing layout accurately and clearly using only a plumbing plan diminishes. This can easily lead to misinterpretations by the users of the plan. In such cases as this, it is common practice to supplement the plumbing plan with riser diagrams.

The most commonly used type of riser diagram for plumbing is the isometric riser diagram. As you see in the examples shown in figures 4-1 and 4-2, the isometric riser diagram provides a three-dimensional representation of the plumbing system. Although a riser diagram is usually not drawn to scale, it should be correctly proportioned. In other words, a long run of piping in the plumbing plan should be shown as a long run of piping in the riser diagram. Conversely, short runs should be shown as short runs. Make sure, too, that you use proper symbols (from MIL-STD-17B) for the piping and fittings. This makes it easy for someone familiar with the symbols to read and interpret the drawing. A glance at figure 4-1 tells you, for example, that the plumbing system contains three gate valves and that all of the fittings are screw-type fittings. Be sure that the pipe sizes are properly labeled, especially where changes in pipe size occur. Label all fixture connections to identify to what fixture the piping connects. In figure 4-1, the fixtures are spelled out; however, it is also common practice to label the fixtures using an alphanumeric coding, keyed to a fixture schedule.

Another type of riser diagram, though less often used in construction drawings, is the orthographic riser diagram that shows the plumbing system in elevation. When used, it is normally reserved for buildings that are two or more stories in height. Also, since you probably cannot clearly describe an entire plumbing system for a building in a single elevation, more than one orthographic riser diagram is necessary for the building. Examples of these diagrams can be found in *Architectural Graphic Standards,* by Ramsey and Sleeper.

ELECTRICAL DIVISION

Included in the electrical section are power and lighting plans, electrical diagrams, details, and schedules. Chapters 9 and 10 of the EA3 TRAMAN provide a discussion of interior wiring materials and the drawing of electrical plans.

Electrical single-line block diagrams are drawings that show electrical components and their related connections in a diagrammatic form. The diagrams, seldom drawn to scale, use standard symbols to represent individual pieces of electrical equipment and lines to represent the conductors or wires connecting the equipment.

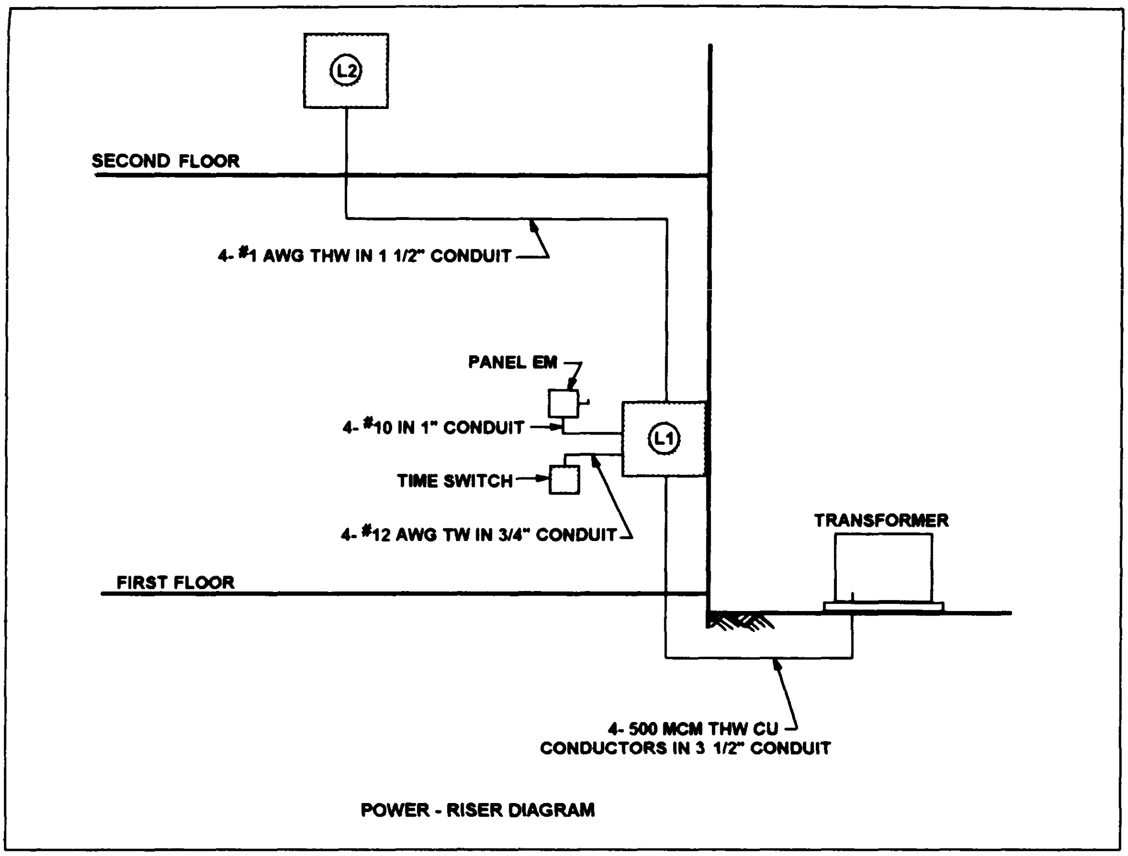

Figure 4-3.—Example of a power-riser diagram.

A simple example is the power-riser diagram shown in figure 4-3. In this example, you see the manner in which two electrical panels *(L1* and *L2)* are planned for installation in a two-story building. As you see, notes are used to identify each piece of equipment and to indicate the number, size, and type of conductors in each conduit. A panelboard schedule for each of the panels should also be included in the drawings to indicate the components, such as fuses or circuit breakers, contained in the each panelboard.

A schematic wiring diagram is similar to the single-line block diagram; however, it provides more detailed information and the actual number of wires used in each circuit is shown. Complete schematic wiring diagrams are usually used for unique and complicated systems, such as control circuits. An example of a schematic diagram is shown in figure 4-4.

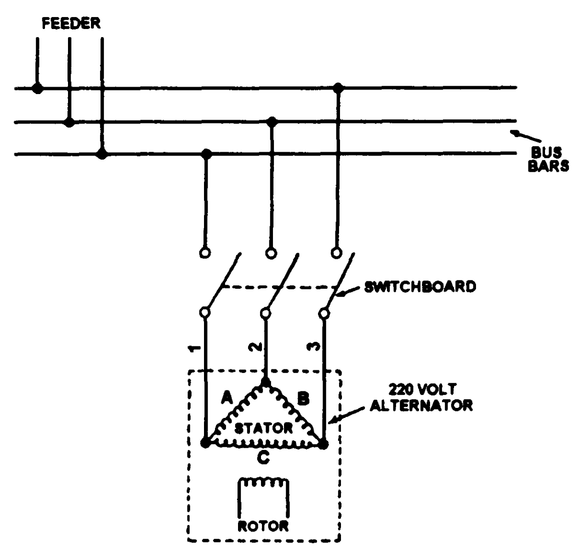

Figure 4-4.—Example of a schematic diagram

FIRE PROTECTION DIVISION

This division includes the plans, details, and schedules that describe the fire protection systems that are to be installed in the building. These systems can include, as applicable, wet-pipe or dry-pipe sprinkler systems, monitoring equipment, and alarms. A discussion of these systems is beyond the scope of this TRAMAN.

HVAC SYSTEMS AND DRAWINGS

Although it's the engineers responsibility to design heating, ventilating, and air-conditioning systems, the drafter who prepares drawings of the systems should have a basic understanding of the operating principles of each. Those principles, and a typical heating and air conditioning layout for a building, are discussed in the

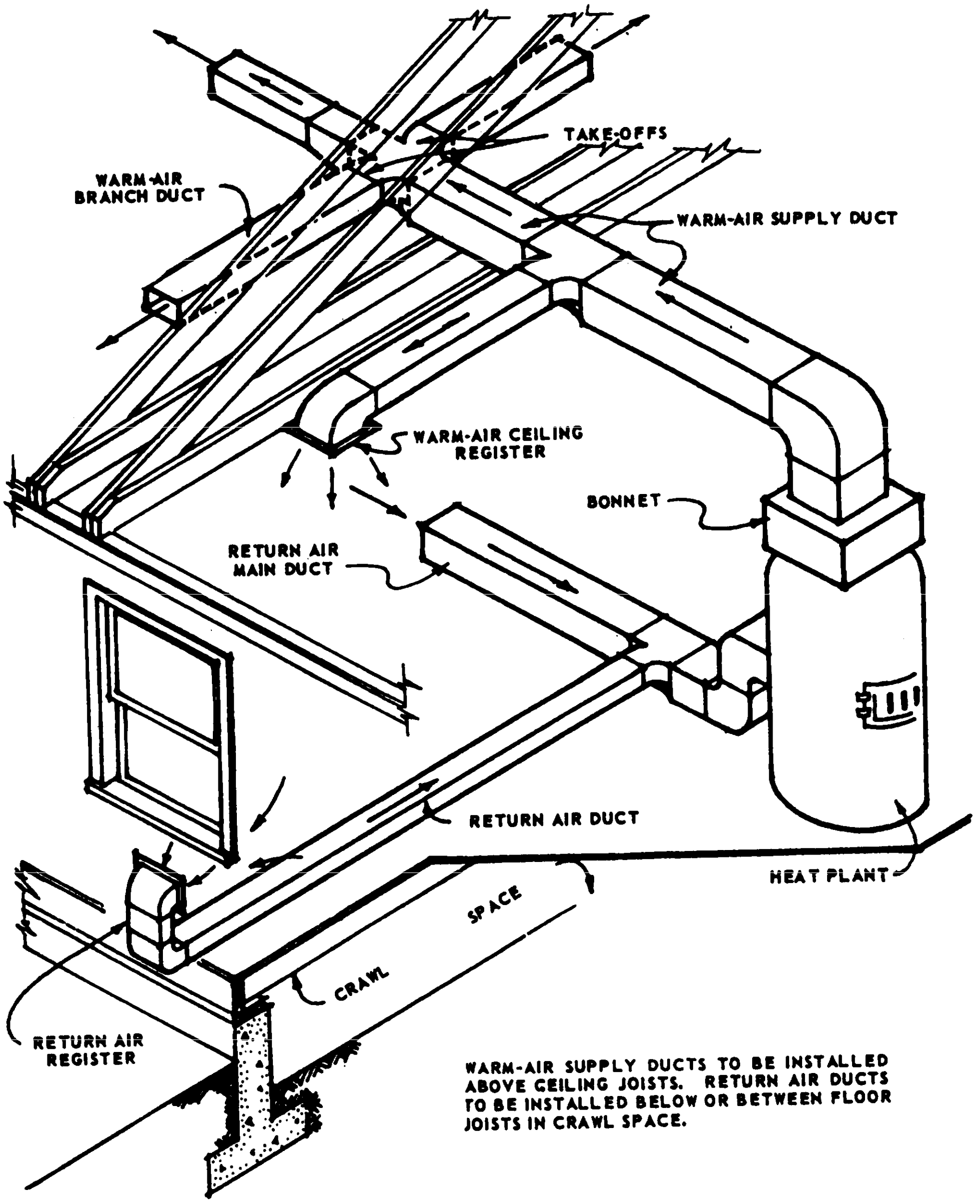

Figure 4-5.—Forced-air heating system.

following paragraphs. For a discussion of heating principles (including theory, measurement of heat, and heat transfer) and a discussion of the principles of refrigeration and air conditioning, you should read chapters 9 and 10 of *Utilitiesman 3,* NAVEDTRA 12532.

HEATING SYSTEM

The purpose of designing and installing a heating system in a building is to provide proper heat distribution to the various rooms or zones within the building. This can be done by means of various types of heating systems.

Warm-Air Furnace Systems

A warm-air furnace can be any type of heating device that circulates warmed air to locations where it is needed. One type, the **wall heater,** draws in cold air near the floor, passes the air over a heating unit, and then exhausts the warmed air to heat the surrounding area Another type is the **gravity warm-air furnace.** It is a direct-fired furnace that transfers heat by convection In other words, warmed air circulating through the furnace rises through ductwork to the areas to be heated and then, as the air cools, it descends to the furmace to be reheated Since the installation of this type of system requires abasement and large, unsightly ductwork, it is seldom used in new construction.

A more commonly used type of warm-air furnace is the forced-air furnace (fig. 4-5). In this type, an oil or gas burner heats the fins of a heat exchanger. The heat exchanger warms the cool air passing over it. The warmed air is then forced, by fan, through relatively small **supply ducts** to the areas to be heated. The air is then returned through **return ducts** to the furnace for reheating. Outside air can be supplied to the return ducts for a continual supply of fresh air.

Forced-air furnaces are controlled by two thermostats: a room thermostat to control the burner and another thermostat to control the blower. Most of these furnaces have filters that eliminate any solid particles in the air before it is heated. These furnaces are also frequently equipped with humidifiers to replace moisture that has been removed from the heated air.

Ducts for forced-air furnace systems can be round, square, or rectangular in shape and can be fabricated from tin-plated steel, fiberglass, or more commonly, galvanized sheet metal using methods discussed in chapter 11 of *Steelworker 3 &* 2, NAVEDTRA 10653-G. Insulation for the ducts usually consist of 1/2-inch to 2-inch-thick fiberglass or rock-wool blankets wrapped around the ducts.

Supply and return outlets may be located in walls, ceilings, or floors. The cover for the outlet may be a decorative grill that covers the end of the duct opening, or it can be a **register** that can be adjusted to vary the amount of airflow. **Diffusers** are used to direct the flow of air. They can be either adjustable or nonadjustable and can also include a register. Supply outlets carrying only hot air are best located in or near the floor. That way, the hot air is introduced to the coolest part of the room, and the cold air is returned through return outlets located near or in the ceiling. When the ducts are used also for supplying cooled air, then the opposite location arrangement is best. A small building, such as a residence, may have a single return air grill located in a central hallway. In this case, doors leading to the hall are undercut by about 1 or 2 inches.

For a more thorough discussion of warm-airheating systems and equipment, you should read chapter 9 of *Utilitiesman 2,* NAVEDTRA 10662.

Steam-Heating Systems

Steam-heating systems consist of a boiler, a piping system, and radiators or connectors. The boiler is fired by oil, gas, coal, or electricity. Although there are many variations and combinations of steam-heating systems, they are all basically either **one-pipe** or **two-pipe** systems.

The one-pipe system uses the same pipe to convey the steam to the radiator and to return the condensate to the boils. When the unit is started, the steam pushes air out of the system through thermostatically controlled air wolves at the radiators. When the air has been expelled and steam reaches the valve, the valve closes automatically. As the steam gives up heat through the radiators, it condenses and runs back to the boiler through the bottom of the supply piping. In the one-pipe system, the mains must be large and sloped to allow the condensate to flow back to the boiler without interfering with the flow of steam.

In a two-pipe system, the steam flows into one end of the radiator and out the opposite end through a thermostatically controlled **drip trap** that is set to open automatically when the temperature drops below 180°F. When enough condensate has collected in the radiator to cool it, the drip trap opens, allowing the condensate to flow into return lines where it is carried to a collecting tank.

A **radiator** used in a steam- (or hot water) heating system usually consists of a series of interconnected, vertical cast-iron sections. As the steam flows through the radiator, the surface of the sections radiates heat to the surrounding walls, objects, and the surrounding air. As the surrounding air is heated, it rises towards the ceiling, setting into motion a convection current that transfers heat throughout the room.

Convectors usually consist of iron or copper pipes surrounded by metal fins and are most often placed near the floor. Openings at the top and bottom of the convector unit allow circulation of air over the fins. That movement of air over the fins transfers heat to the surrounding area. Small connectors placed around the base of the wall are termed *baseboard heaters.*

For a more thorough discussion of steam-heating systems and equipment, you should read chapter 7 of *Utilitiesman 2,* NAVEDTRA 10662

Water-Heating Systems

A water-heating system includes a boiler, a piping system, radiators or connectors (discussed **above),** and a water-circulating pump that is used to force the water to the radiators or connectors and back to the boiler. For water heating, three types of piping systems are used.

The **one-pipe** system (fig. 4-6) consists of a single supply main that carries hot water to each radiator in turn. To overcome a loss of water temperature at each successive radiator, you must balance the size of the piping or the orifice at the radiator.

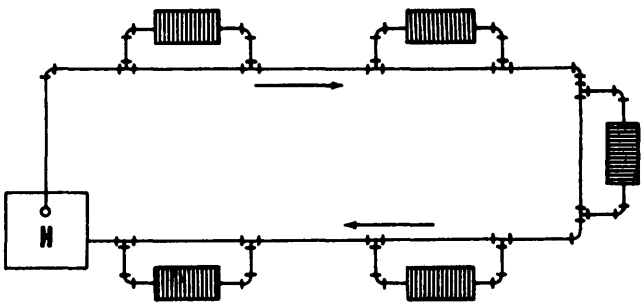

Figure 4-6.—One-pipe water-heating system.

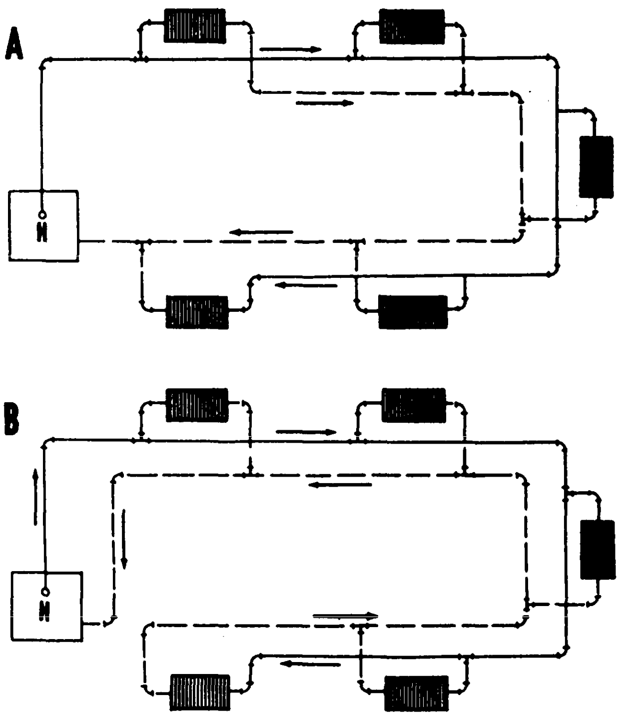

Figure 4-7.—Two-pipe water-heating system: A. direct return; B. reverse return.

A **two-pipe** system is shown in figure 4-7. In this system, the supply main carries hot water, and the cooled water is returned through a separate return pipe.

For a more thorough discussion of hot-water heating systems and equipment, you should read chapter 10 of *Utilitiesman 2,* NAVEDTRA 10662.

Unit Heaters

Unit heaters are either gas-fired units or they consist of coils of tubing that circulate hot water or steam. A built-in fan behind the unit or coils blows the heated air throughout the area it is heating. When used, unit heaters are usually suspended from ceilings or are mounted high on walls in large, open areas of garages, shops, and similar facilities.

Radiant-Heating Systems

When you are in a cold room, your sensation of chill is due more to the loss of your body heat to the surrounding surfaces than to the temperature of the air. To compensate for this condition, a radiant-heating (or panel-heating) system warms the surrounding surfaces so that you are more comfortable at a lower air temperature. This type of heating system consists of hot-air pipes, hot-water pipes, or electric coils that are embedded in walls, floors, or ceilings.

VENTILATING SYSTEMS

Most ventilating systems take advantage of the natural environment. The ventilating system is designed to use the natural forces of wind and interior-exterior temperature differences to cause circulation and maintain a continuous freshening of the internal air. In general, air is permitted to enter through openings at or near floor level and allowed to escape through openings high on the walls or in ceilings and roof.

In mechanical ventilation, air circulation is induced by mechanical means-usually by fans-that may be combined with supply and exhaust duct systems.

AIR-CONDITIONING SYSTEMS

Providing complete "comfort conditioning" for a building involves more than simply controlling temperature. It also includes providing balanced humidity; fresh and clean air that is free of odors, dirt, dust, and lint particles; and controlled air motion. **Air conditioning** is the process that provides and controls all of those conditions.

The cooling and warming of the air is usually referred to as winter and summer air conditioning. Winter and summer air conditioning is done by installing both cooling and heating equipment in the air-conditioning system. Of course, single units for heating and cooling may be used separately.

Heating equipment for winter air conditioning is most often automatic. Heating coils, usually built into the air-conditioning unit, give up heat from the water or steam that passes through them from a heating unit. Heat may also be generated within an air-conditioning unit directly by a gas-heating unit or by an electric heater. No matter what type of heat is used, the goal is to heat the air.

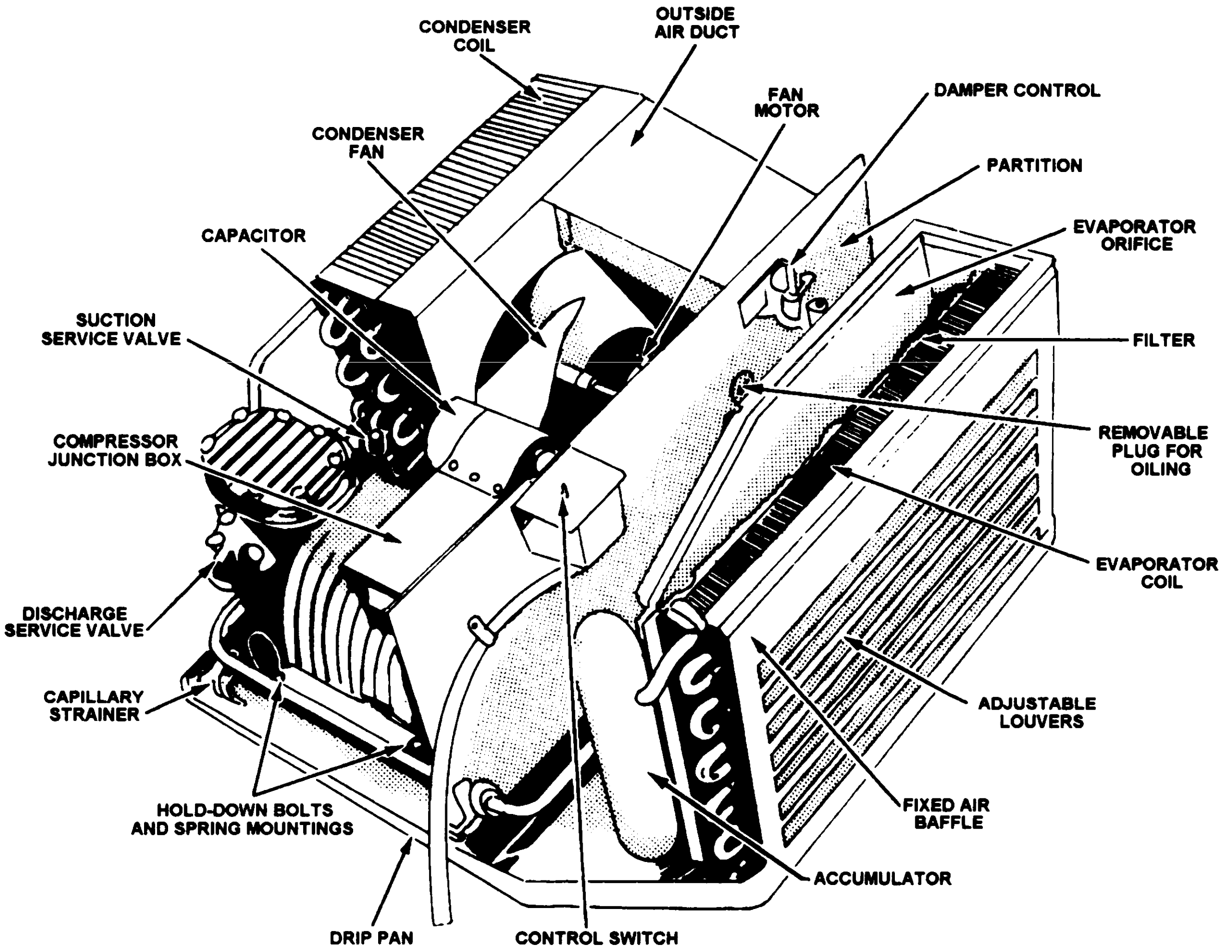

Figure 4-8.—Window air conditioner.

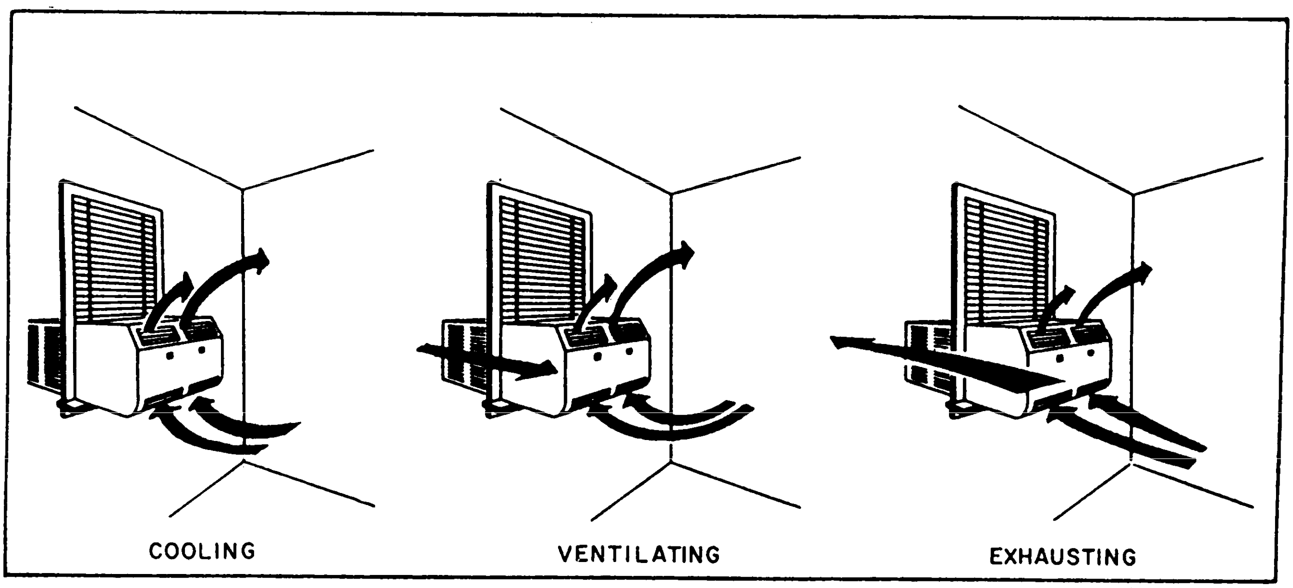

Figure 4-9.—Window air conditioners, showing airflow patterns for cooling, ventilating, and exhausting.

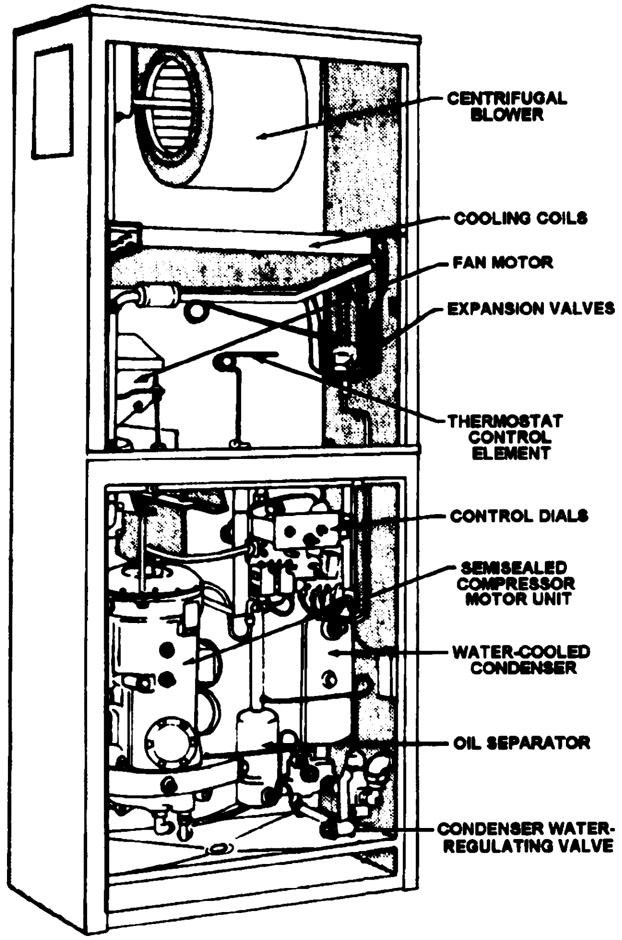

Figure 4-10.-Floor-mounted air-conditioning unit (shown with cover panels removed).

Cooling equipment for air conditioning must be of a type that will satisfactorily cool the air for a particular space that is being air conditioned. One method used to cool air in air-conditioning units is to evaporate water. A discussion of this method, called *evaporative cooling,* can be found in chapter 10 of the UT3 TRAMAN. Another method, and one of the most important, is **mechanical refrigeration.** In this method, the air that is to be conditioned and cooled is blown through cooling coils having a temperature of about 50°F. This not only cools, but dehumidifies the air. A discussion of this method can also be found in chapter 10 of the UT3 TRAMAN.

There are various types of air-conditioning units and systems. A few of the common types are discussed below.

Self-Contained (Package) Units

Self-contained refrigerative air-conditioning units are either window units (figs. 4-8 and 4-9) or larger floor-mounted units (fig. 4-10). Both types of units contain a complete system of refrigeration components.

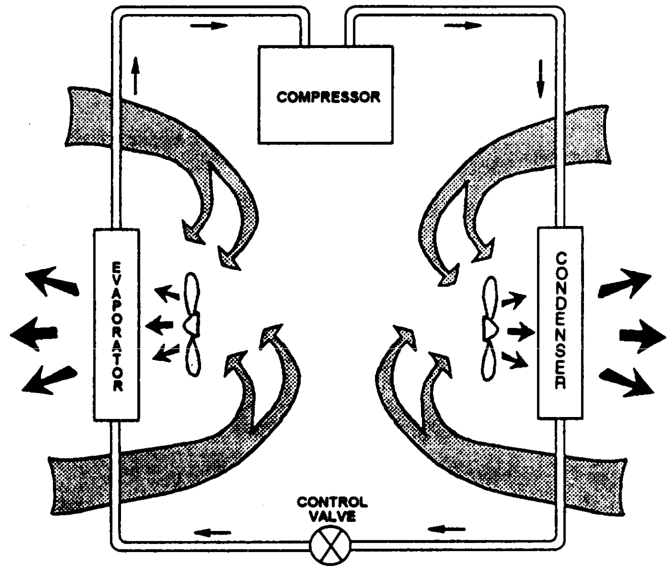

Figure 4-11.-Refrigerating cycle of a package type air-conditioning unit.

The window units need not be installed in windows. They also can be installed in transoms, or they can be framed into outside walls. The use of outside walls is important for proper performance. When the unit is operating, the compressor (fig. 4-11) forces a high--pressure (high-temperature) refrigerant gas to the condenser. The condenser fan draws in and blows outside air over the condenser coils. This movement of the relatively cooler outside air over the hot condenser coils changes the gas to a liquid, giving off heat that is exhausted to the outside. The liquid then passes through a control device that regulates the flow of the liquid to the evaporator. In the evaporator, the liquid changes to a low-pressure (low-temperature) gas that is circulated through the evaporator coils. The inside or room air is then circulated by an evaporator fan over the cold evaporator coils. This action removes heat from the air and returns the cooled air back to the room.

A variation of this type of unit is the **heat pump.** In a heat pump, the roles of the condenser and the evaporator can be reversed so that the unit draws in and heats outside air and expels cold inside air. In this way, the unit functions as a heating unit, rather than a cooling unit.

Cooling Coils

Most forced-air furnaces are designed for the addition of a cooling coil. The coil is placed on the output side of the furnace and uses a forced-air furnace blower to circulate the air over the cooling coils. The addition of a dehumidifier reduces moisture in the air. The cooling unit, placed in any convenient location outside the building, produces chilled water that is circulated through the cooling coils near the air-conditioned space. The air to be conditioned is then blown over the cooling coils and is cooled by the chilled water absorbing the heat from the air. The warmed water is then returned to the unit.

Fan-Coil Units

You have probably seen fan-coil units in a school or motel room. These units contain a fan, coil, falter, condensate drain, and sometimes, an outside-air inlet. A central unit furnishes air to the unit, and duct coils heat or cool the air. The amount of air moving over the coils and the temperature of the coils can be manually or thermostatically controlled. A piping system provides hot or cold water to each unit.

HEATING AND AIR-CONDITIONING LAYOUT

Figure 4-12 (a foldout at the end of this chapter) shows a heating and air-conditioning layout for a hospital. You can see that the air- conditioning plant consists of four separate self- contained units, three of which are located in the mechanical equipment room, and one on the porch of the ward. Note the cooling towers, that have not as yet been mentioned. In a water-cooled air-conditioning system, cold water is run over the coils of the condenser (rather than air being blown over the coils). The purpose of the cooling tower is to cool the water. Water is sprayed at the top of the tower, and as it falls through the redwood louvers, it is cooled by the air. Sometimes, large blowers force air through the water, making the cooling tower more efficient. You can read more about cold-water air-conditioning systems in the UT2 TRAMAN.

In figure 4-12, you can see the line of air-conditioning ducts running from each of the air-conditioning units. Note that the section dimensions of each length of specified size are noted on the drawing. Notice, too, that these dimensions decrease as distance away from the unit increases.

You should notice, also, that some spaces are heated by radiators, rather than the air-conditioning system. These spaces (all the toilets, for example) may contain odors or gases that would make it inadvisable to connect them with the air-conditioning duct system. On each of the radiators, the heating capacity, in British thermal units (BTUs), is inscribed. In each space not connected to the air-conditioning system, you can see an exhaust fan (for ventilation) shown. On each fan, the air capacity, in cubic feet per minute (CFM), is noted.

In each air-conditioned room, you see a circle (or more than one circle) on the duct. This indicates an outlet for the conditioned air. In this case, the outlets are diffusers, and the capacity of each diffuser, in CFM, is inscribed. Note that this capacity varies directly with the size of the space serviced by the outlet.

Steam lines from the boiler in the mechanical equipment room to the air-conditioning units and radiators appear as solid lines. Small diagonal lines on these indicate that they are low-pressure steam lines. Returns appear as dashed lines.

In the upper left corner, a detail shows the valve arrangement on the steam and condensate return lines to each of the air conditioners. Referring to the mechanical symbols specified in MIL-STD-17B, the detail indicates that in the steam line, the steam headed for the unit passes agate valve, then a strainer, and then an electrically operated modulating valve. This last reduces the pressure to that for which the unit coils are designed.

The steam condensate leaving the unit first passes a gate valve, then a strainer, then a union, and then a steam trap. This trap is a device that performs two functions: (1) it provides a receptacle in which steam condenses into water and (2) it contains an automatic valve system that periodically releases this water into the rest of the return lines.

Beyond the steam trap, there is another union, next comes a check valve, and finally a gate valve. A check valve, as you know from the EA3 TRAMAN, is a one-way valve. It permits passage in one direction and prevents backup in the opposite direction.

CHECKING AND EDITING CONSTRUCTION DRAWINGS

Every drawing prepared in the drafting room must be checked and edited. As a capable EA2, you maybe delegated the job of doing so. When **checking** a drawing, you are inspecting it to make sure that it accurately conveys the information contained in the data source. That source may be survey field notes, sketches, written data, another drawing, or any combination of these. Any error or omission of information in these sources will result in inaccuracies in the drawing; therefore, the first check is to make sure that the source accurately provides everything needed to make the drawing. "Editing" means that you are inspecting the drawing to make sure that the procedures and conventions prescribed in relevant NAVFAC publications and military standards are followed. It might be said that editing begins as soon as drawings begin-meaning that you must constantly edit drawings to ensure that proper procedures and conventions are followed at the time the drawings are made.

When checking and editing a detail drawing, the checker ALWAYS uses a print of the drawing, rather than the original. That way, any corrections that need to be made can be marked with a colored pencil or pen on the print without disturbing or destroying the original. The detail drafter then uses the marked-up print to make corrections to the original drawing. After all of the corrections have been made, the checker compares a print of the corrected drawing with the originally marked-up print.

For a thorough job of checking and editing, you should first make an overall check with the following questions in mind:

1. Does the drawing reproduce well? Any poorly defined or weak line work and lettering must be corrected.

2. Does the size and format of the drawing conform to the MIL-HDBK-1006/1 requirements for Naval Facilities Engineering Command (NAVFACENGCOM) drawings? As specified in that publication, the project drawings should be prepared on flat C-, D-, or F-size paper. It also specifies that a vertical title block format is mandatory for D-size drawings and optional for F-size. Examples of both horizontal and vertical format title blocks can be found in MIL-HDBK-1006/1.

3. For a set of drawings, is a different drawing number assigned to each sheet and are all of the drawing numbers correct? Is the set of drawings arranged in the correct order as specified in MIL-HDBK-1006/1. That is, are they arranged as follows:

a. Title sheet and index of drawings (only for projects containing 60 or more drawings).

b. Plot and vicinity plans (including civil and utility plans). This sheet should include an index for small projects.

c. Landscape and irrigation.

d. Architectural.

e. Structural.

f. Mechanical (heating, ventilating, and air conditioning).

g. Plumbing.

h. Electrical.

i. Fire protection.

If the overall check is satisfactory, proceed with more detailed questions, such as the following:

1. Is the method of projection appropriate?

2. Are the views shown the minimum number required to show all the data?

3. Are sectional views constructed correctly and is the section lining correct?

4. Are line conventions and symbols consistent with the requirements of appropriate and current standards? Are all symbols (especially nonstandard ones) explained in a legend?

5. Are proper scales used for the drawing and are the scales shown? Appropriate scales for construction drawings are as follows:

a. Floor plans and elevations: 1/4", 3/16", 1/8", or 1/16" = 1´ – O".

b. Architectural details: 3/4", 1 1/2", or 3" = 1´ – 0´.

c. Molding sections and similar details: full scale or half scale.

d. Mechanical and electrical details: 3/8", 1/2", 3/4", or 1" = 1´ – 0´.

e. Structural details: 3/8", 1/2", 3/4", or 1" = 1´ – 0´.

f. Structural erection drawings (such as structural floor and roof framing plans): 1/8" or 1/16" = 1´ - 0".

g. Site (plot) plans: 1" = 10´, 20´, 30´, 40´, 50´, 60´, 100´, or 200´.

h. Utility plans: 1" = 20´, 30´, 40´, or 50´.

6. Are graphic scales shown as required by NAVFACENGCOM (MIL-HDBK-1006/1)?

7. Do the dimensions agree with those shown in the data source? Does the sum of partial dimensions equal the overall dimensions?

8. Are all of the required dimensions shown? Are there superfluous dimensions that are not needed?

9. Are all necessary explanatory notes given? Are all general notes in their proper location on the drawing?

10. Are terms and abbreviations consistent with military standards? Are the abbreviations (especially unusual ones) explained in a legend?

In addition to all of the above, you also should be constantly alert to misspellings and the improper use of phases and statements. Oftentimes, phases and statements that are used in common practice are not acceptable for use in project drawings. Listed below are some of the most common errors found in project drawings. (A correction follows each incorrect phrase or grouping of phrases.)

1. Incorrect: "As instructed by the architect."

   Correct: "As directed" (Note, however, that you should avoid using this type of language since it indicates uncertainty as to what the requirements are.)

2. Incorrect: "As approved by the architect."

   Correct: "As approved."

3. Incorrect: "By the Navy."
   "By others."

   Correct: "By the Government."

4. Incorrect: "By the electrical contractor."
   "By the plumber."
   "By the plumbing contractor."

   Correct: (Usually no statement is necessary since the government recognizes only the prime contractor.)

5. Incorrect: "12 gauge zinc-coated steel flashing."
   "copper flashing."

   Correct: "Metal flashing." (Metals are referred to only as metal and not as a particular kind or gauge. Type and weight should be covered in the project specifications.)

6. Incorrect: "Formica."

   Correct: "Laminated plastic." (Proprietary or brand names are not permitted.)

QUESTIONS

Q1. Into what drawing divisions should you place drawings that &scribe each of the following types of information?

a. Number and size of treads and risers in a stairway

b. Bearing and distance of property lines

c. Equipment for HVAC systems

d. Steel reinforcing requirements for beams and columns

Q2. In which of the following ways does a forced-air furnace differ from a gravity warm-air furnance?

a. It uses a fan for circulation of the heated air

b. It requires smaller ductwork

c. It can be equipped with cooling coils

d. All of the above

Q3. In what primary way does a heat pump differ from a window air-conditioning unit?

Q4. "Effective temperature" is the net effect of three factors that affect human health and comfort What are those three factors?

Q5. What NAFACENGCOM publication provides basic guidance and policy for the preparation of project drawings?

Q6. When using the international system of units, what SI unit (meter, millimeter, or centimeter) should you NOT use for project drawings ?

Q7. What title block format must you use when preparing NAVFACENGCOM project drawings on 22- by 34-inch tracing paper?

Q8. For a large set of project drawings, what letter should you place near the title block to designate those sheets of drawings that are in the plumbing division?

Q9. When is it permissible for you to reuse a NAVFAC drawing number?

Q10. What is the primary reason that you should always check line weights when checking and editing drawings?

FIGURE REMOVED

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Figure 4-12.—Heating and air-conditioning layout.